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The educational technologist as a teacher
MA thesis

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Abstract

This research is a qualitative case study investigating the experience of a teacher educational technologist who supports another teacher of the same subject. The study aims to understand how the teaching experience of a teacher educational technologist will impact the support that is provided. Through surveys, interviews, observations and reflections, the growth of the learner teacher and teacher educational technologist are recorded as the two engage in support sessions, lessons and reflection sessions. Data from a third individual, the school's employed educational technologist, is collected for comparison. The research shows that there are similarities and differences between the two educational technologists and that the digital pedagogy support offered by the teacher educational technologist is the strength of that role.

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Introduction

Technology continues to develop at a rapid pace and has become a prevalent tool in our lives. From handheld devices like tablets and cell phones to flying drones, underwater cameras, and self-driving vehicles, technology has become part of our everyday routine. It is not just for fun or convenience either; the COVID-19 pandemic has shown us that the use of digital technology is critical in crisis situations (United Nations Department of Economic and Social Affairs, 2020; United Nations Division for Public Institutions and Digital Government, 2020). Even though people were strongly encouraged to self-isolate in their homes during this time, for many, work and school were able to continue. Certainly there were modifications, but many people were able to continue activities and stay connected, even while asked to remain apart.

With technology widely available and able to offer many benefits, it is important that people learn to use technology effectively. One could argue that this should start in schools, where teachers support students to learn about technology and begin to explore the digital world and all it has to offer. On a very basic level, this is the purpose of educational technology. Indeed, many organizations including the Estonian Ministry for Education and Research, the International Society for Technology in Education (ISTE), and the European Commission all have publications discussing the need to incorporate technology into teaching and learning (Estonian Ministry of Education and Research, 2014; International Society for Technology in Education, 2017; Redecker & Punie, 2017). However, implementing technology use into the classroom presents new challenges for teachers, many of whom have not been taught how to teach using technology (Niess, 2005).

One way for schools to support teachers in implementing technology into their classrooms is to hire an educational technologist. To do this though, schools should know what their expectations are for such a position. Unfortunately, the role of an educational technologist is different for each school, which makes it difficult to definitively say who is an educational technologist, what competencies they should possess and what their responsibilities should include. Further support of the difficulties of defining the role of an educational technologist will be presented in the literature review.

If the role of an educational technologist is, in fact, difficult to define, then where does one start looking for a person to fill the role? Corbeil and Corbeil (2013) indicate that the educational technologist should have a broad range of skills and experience with learning technologies that can be applied in different contexts, but what does that look like in practice? Should schools look for someone with Information Technology (IT) skills, computer programming skills, or curriculum development skills? Should the person have leadership capabilities and years of experience in a school setting or can anyone with experience using technology fill this role? Is it possible that schools already employ the type of person that they are looking for, say one of their teachers? The literature for this situation, that of a teacher in the role of an educational technologist, is very little. For this reason, I will investigate the experience of a teacher educational technologist with this research.

In order to gain insight, I established a situation where a teacher steps into the role of an educational technologist and works with a learner teacher. The methodology is explained in a later section, but first, in order to clarify the work, some terms will be explained. The teacher educational technologist in this research is someone who possesses digital pedagogy skills and teaches the same subject as the learner teacher. In general, a teacher educational technologist could teach any subject, however, the significance of teaching the same subject impacts this particular research and should be noted. The general educational technologist is the person who is already employed by the school as the educational technologist. The descriptor ‘general’ is chosen because this person’s particular strengths are not considered and in this situation the key characteristic for the general educational technologist is that they do not have teaching experience. The learner teacher is one who is learning about technology, learning how to implement digital tools into their classroom and, ideally, developing some digital pedagogy skills along the way. The term learner teacher does not mean that this person is someone preparing to enter the teaching field for the first time. Throughout the report, reference to digital pedagogy will occur so I also include this quotation to provide some clarity: Digital pedagogy is

not about using digital technologies for teaching, rather, about approaching those tools from a critical pedagogical perspective. So, it is as much about using digital tools thoughtfully as it is about deciding when not to use digital tools, and about paying attention to the impact of digital tools on learning (*What Is Digital Pedagogy?*, 2020).

The concept of digital pedagogy is an important component of educational technology. If the goal of educational technology is to implement technology into teaching and learning to provide a better learning experience, then the approach to meaningful use of digital tools is important for teachers and educational technologists.

Theoretical Overview

Literature Review

By consulting relevant literature relating to the concepts of educational technology and educational technologists, one quickly notices that there are and have been many differing views and perceptions of what these terms might mean. Many authors draw attention to the changing role of educational technologists or the difficulty defining the role as they attempt to provide some clarity of the concepts (e.g. Lawless and Kirkwood (1976), Hawkrigde (1991), Simsek (2005), Fox and Sumner (2014)). A brief look at some of the literature throughout history can help us to come to a better understanding of the varying roles, responsibilities, competencies and expectations which surround educational technologists. In turn, this can help us to understand the type of person who may or may not be well suited for the position.

As one of the early researchers trying to define the educational technologist role, Mitchell (1975) determines that “five roles are delineated: learning consultant, educational materials producer, manager of learning resources, educational systems developer and educational planner” (p. 306). Some years later, Rossett and Garbosky (1987) asked educational technology graduates what they ideally wanted to do in their work and they responded “problem solving, curriculum development, instructional design, curriculum evaluation and staff development” (p 38). Likewise, Davidson (2003) looks into the roles of educational technologists and writes that “there were four primary and competing definitions for understanding the ET [educational technologist] position: the technician, the classroom teacher, the specialist, and the administrator. Later, a fifth competing definition arose: the ET as district curriculum specialist” (p. 736). Aslan and Reigeluth (2013) discuss the role of educational technologists in supporting a paradigm shift in education

and indicate that they should take on a leadership role in developing the technology tools, instructional design, and assessment designs to make this happen. They also encourage educational technologists to continue research and development in the field. Simsek (2005) reported a total of 43 different terms used by educational technologists to express their work areas and, a few years later, Corbeil and Corbeil (2013) indicate that respondents in their survey provided a total of 52 roles that are associated with the work of educational technologists.

As one can see, it can be difficult to summarize all the titles and terminologies related to the educational technologist. The studies quoted above provide a snapshot of ideas that demonstrates the concept of who an educational technologist is, or what he does, is quite broad. To further complicate things, each of these titles comes with its own list of responsibilities, competencies and expectations.

Ritzhaupt, Martin and Daniels (2010) and Ritzhaupt and Martin (2013) share the top competencies, (e.g. knowledge, skills, and abilities) that educational technologists should possess, according to their analysis of job listings and surveys from practicing professionals. “The analysis revealed over 85 key multimedia competencies” (Ritzhaupt and Martin, 2013, p. 19) and determined that the most important knowledge was that of “theories and methods of instruction, which included items like cognitive theories of learning, motivation theories, instructional design models/principles, and adult learning theory” (p. 25), the most important skill was “soft skills, which includes several areas like oral and written communications, interpersonal skills, or customer service skills” (p. 26) and the most important ability was being able to work in a team-oriented environment. The work from Corbeil and Corbeil (2013) also indicated skills of educational technologists and the list included teaching/mentoring, online teaching, web design, multimedia development, blended learning and working collaboratively.

Based on descriptions provided by the survey participants, educational technology professionals are leaders, collaborators, team players, problem solvers and change agents. They are teachers, mentors, tutors, and guides to their students, colleagues, and coworkers. They assess needs and design, develop, implement and evaluate learning solutions using innovative pedagogical and technological strategies. They are lifelong learners, researchers, planners, advocates, and avid readers of all things related to educational technology and best practices in teaching and learning and technology integration. In order to perform their many job functions, they are naturally curious, knowledgeable, flexible, multitalented, creative and driven. In essence, the educational technology professional has a broad range of skills and

expertise that can be applied in a variety of contexts and roles to multiple ends.
(Corbeil & Corbeil, 2013, p. 345)

It is no wonder that people struggle to explain or even understand what it is that educational technologists actually do!

What is interesting to note, is that the summary of competencies listed above have a lot of overlap with the competencies of teachers. Like with educational technologists, the idea of what constitutes teacher competencies varies among education stakeholders. Sleezer et al. (2007) defines competency as the “knowledge, skills, attitudes or behaviors that enable one person to perform activities of a given occupation or function to the standards expected in employment” (Sleezer et. al., 2007, p. 152). Selvi (2010) uses this definition and summarizes the main features of teachers' competencies. These include Field Competencies, Research Competencies, Curriculum Competencies (which includes both curriculum development competencies and curriculum implementation competencies), Lifelong Learning Competencies, Social-Cultural Competencies, Emotional Competencies, Communication Competencies, Information and Communication Technologies (ICT) Competencies and Environmental Competencies. From this list, curriculum competencies, communication competencies and ICT competencies are often highlighted in the literature as important skills for educational technologists (e.g. Kemp (1991), Jenkins and Rossett (2000), Davidson (2003), Lorenz, Kikkas and Laanpere (2014)). Each of these competencies can be further broken down into more specific knowledge and skills but these are not the focus of this paper. The purpose for including the list is simply to demonstrate that there are similarities between educational technologist and teacher competencies.

Included below, in figure 1, is a proposed visual of the overlapping competencies of educational technologists as interpreted from the literature review. It attempts to show the overlapping nature of work-related competencies and educational values of educational technologists (Kanuka et al., 2013) and teachers. The non-symmetrical cloud shape at the center is meant to represent the fluid nature of competencies and values among individuals. This fluid nature can also represent differences of overlapping sections, depending on the particular individuals involved in a comparison.

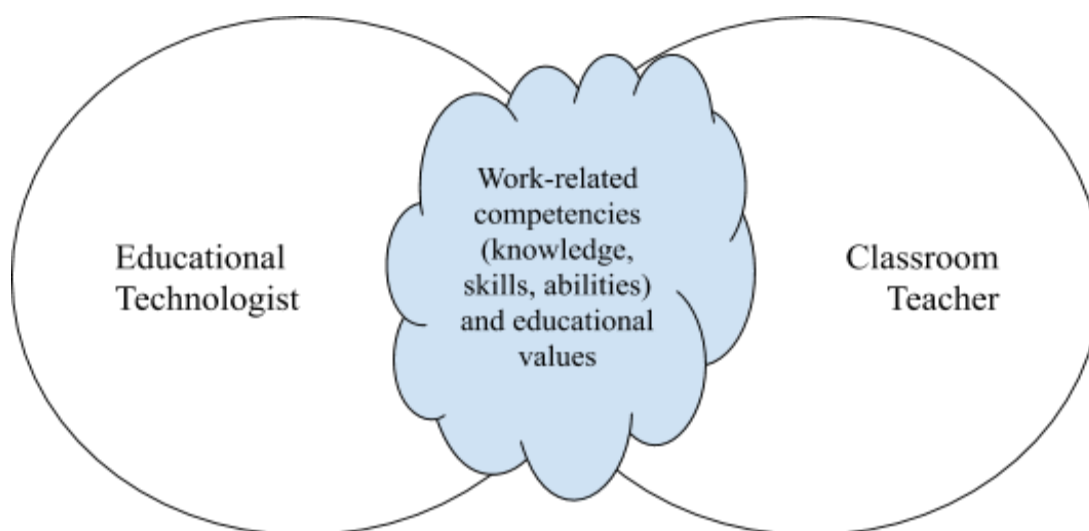


Figure 1. Overlapping competencies of the educational technologist and teacher as interpreted by the literature review

Considering the overlapping competencies, a review of the literature does not yield many studies which look at the educational technologist role filled specifically by a teacher. Some of the literature states ‘teacher’ or ‘tutor’ as a possible role, and there are some pieces of literature that point toward the idea of a teacher educational technologist, but none of them seem to delve into the idea too deeply. Those sources which do point to the idea of a colleague educational technologist are summarized below.

Rossett and Garbosky (1987) focused their research on the perspectives of ten school-based educational technology graduates. These individuals, who at the time were employed as classroom teachers, shared their perspective of the field of educational technology, including the optimal situation, the actual situation and their feelings about the actual situation. From the study we learn that these individuals envision an optimal situation which involves themselves as educational technologists using instructional design skills to help to infuse technology into classrooms. In reality, their competencies were often overlooked by their colleagues. "They don't recognize instructional design skills [...] They do recognize computer skills" (Rossett & Garbosky, 1987, p. 38) and, as such, they express frustration that they are only able to utilize their skills in their own classrooms.

As a follow-up to that research, Garbosky (1994) shares findings from a second study with the same individuals. By repeating a similar study some years later, he tries to gain insight of the changes that occurred. In the second study, participants informed that, while most of them are still classroom teachers, their skills have started to be recognized and utilized a bit more. Some of the participants have since provided training for students, parents and teachers and contributed to curriculum development, hardware and software purchasing, needs assessments and the design of district plans or management and evaluation systems. These articles seem to indicate that people can fulfill teaching and educational technologist duties simultaneously. It is relevant to the current research that these individuals held the same role to be explored, that of a colleague teacher with the skills and competencies of an educational technologist able to support the infusion of technology into classrooms.

Davidson et al. (2001) provides another interesting and relevant piece of literature for the current research. Their study focuses on the work of educational technologists in four different schools. The study looks at the experience, skills and characteristics of the people who fill the role of educational technologist at these schools and discusses the relative success or failure of these individuals. The study determines that one of the educational technologists who “does not have a technology endorsement or an extensive knowledge of technology” (p. 12) but who does have prior experience in teaching was the one who demonstrated the most success in her role as an educational technologist. This further lends support to the idea that a teacher with no specific educational technology training may be able to successfully fill the educational technologist role.

Lorenz, Kikkas and Laanpere (2014) focuses their work on learning about educational technologists in schools in Estonia. They list challenges of both educational technologist and schools when hiring for the position and state that “some advanced ones [teachers] can be asked to join the educational technologist training or made to present something to the colleagues” (p. 293). Fox and Sumner (2014) state that educational technologists in their study “worked in a hybrid role between the academic and professional fields” (p.94) and therefore they need to have pedagogical knowledge as well as technical knowledge. These quotes also point toward the idea of a teacher being able to fill the role of educational technologist.

The work from Bardone, Tonni and Chounta (2020) focuses on the educational technologist as a “variety handler.” The work focuses on that individual through the lens of Stafford Beers’ Viable System Model. They argue that, while the educational technologist does take on many roles, the main purpose of the educational technologist is to either attenuate or amplify one’s variety in order that “[the teacher and learner] can focus on the teaching and learning process” (p. 5). Their article concludes that “the role of variety-handling could have been taken on by a person not specifically employed with the title of educational technologist. At least in theory - the role could be taken on by a teacher or by the teacher and their students.” (p 22). If indeed the educational technologist is someone with the ability to handle variety presented by technology use, then it seems plausible that a teacher could step into this role. Many teachers have experience handling variety and have, perhaps unconsciously, developed ways of either attenuating or amplifying variety in order to make for better learning experiences for their students. While one may not use the same terminology, the experience that a teacher brings with them, that experience of handling variety, may contribute to a successful outcome in the role of an educational technologist.

In the current context

The literature indicates that the concept of an educational technologist has changed over time. As technology tools are constantly changing, the expectations surrounding the educational technologist must also change. However, the core goal of educational technology does not change. According to the Estonian Ministry of Education and Research (2014) “The objective is to apply modern digital technology in learning and teaching in a more efficient way and with better results, to improve the digital skills of the general population and to guarantee access to the new generation of digital infrastructure” (p. 15). The document goes on to detail providing support to school leadership, teachers and learners in order to meet that objective. While the document does not explicitly state who is responsible for each different type of support that is

listed, it is logical to assume that the educational technologist would have some role in providing this support.

If the object of educational technology is that which is quoted above, then one of the key roles for educational technologists, in my opinion, is to support teachers to work autonomously. To do this, teachers need help developing digital pedagogy. Digital pedagogy requires finding, evaluating and implementing technology tools into the classroom that are engaging as well as useful. It also requires that the transition to technology use be smooth enough to keep the students engaged and focused. It is not a skill that one acquires overnight. For this reason, I propose that a teacher educational technologist would have something very valuable to offer. “Not only do [they] bring expertise in teaching pedagogy and educational content, [they] also serve as the voice of the ultimate end users--teachers and students. As a teacher, [they] have an intuitive sense of what works and what doesn't” (Chang, 2014).

With this research, I propose that the teaching experience of a teacher educational technologist (e.g. subject content knowledge, working directly with students, lesson and unit planning, preparing and conducting assessments, etc.) influences the support that they can provide to other teachers. As a teacher stepping into the role of an educational technologist, I will experience what goes into providing support to another teacher. Then I can compare the support that I provided to the support provided by the general educational technologist who is currently employed at the school. With this knowledge, I will attempt to answer the following research questions:

1. How has the learner teacher grown in their practice as a result of support from a teacher educational technologist as opposed to the general educational technologist?
2. What are the potential benefits/downfalls experienced by a teacher educational technologist?
3. What can a teacher in the role of educational technologist offer that someone hired as a general educational technologist cannot, and vice versa?

The methodology for this research is explained in the next section, followed by the results and a discussion providing answers to the research questions based on the outcomes of the research.

Methodology

The research was conducted such that the researcher fills the role of a teacher educational technologist and helps a colleague, who teaches the same subject, to develop their knowledge of technology and digital pedagogy skills. Due to time constraints and the mandatory distance learning which was implemented as a result of the COVID-19 pandemic (Estonian Ministry of Education and Research, 2020), I decided that it would be most insightful to work closely with one individual and be able to thoroughly support him through the experience.

The research follows the format of a single case study where open-ended, emerging data was collected through the use of surveys, interviews, observations and collaboration with the participant (Creswell, 2003). A benefit of this research method is that “case studies allow you to focus in depth on a ‘case’ and to retain holistic and real-world perspective” (Yin, 2018, p. 35). The qualitative data that is collected is rich in detail and offers insights into the thoughts and opinions of the participants (Macdonald et al., 2008). This research approach also has ethnographical characteristics, as the researcher engages with the participant in a naturalistic setting with the purpose of obtaining detailed description of events and gaining insights into their meaning (Gibbs, 2012).

The choice to focus on one participant ensured that I could offer this participant more attention and support, which created the opportunity to gain deeper insight into the experience of a teacher educational technologist. Alternatively, more participants would have provided more data and perspectives, but time constraints and the need to distribute my attention to multiple teachers may have prevented the ability to take a more nuanced look at the experience of someone who is both a teacher and an educational technologist.

The data was collected through the use of surveys, interviews, observations, conversations and reflections held in-person and through digital channels. Whenever possible, audio or video recordings were collected. Researcher reflections of the events were recorded within 24 hours of the observation/interaction. Additionally, digital traces of communication (e.g. email messages, text messages, etc.) were collected and analyzed to better understand the challenges and needs of the participants during the experience.

As a single case study focused on the experience of one teacher educational technologist, working with one learner teacher, it is difficult to generalize the results and the insights gained to the greater populations of teachers. However, “case studies [...] are generalizable to theoretical propositions” (Yin, 2018, p. 53) Thus, the data and the results will be analysed and discussed in order to gain insight into the experience of having the educational technologist role filled by a teacher. From there, one can consider the potential benefits or hindrances of such a setup.

Sample

The research questions address the experience from both the teacher educational technologist and the learner teacher perspectives and so the sample includes these two people. Data is collected for comparison from a third individual, the educational technologist employed by the school, but she is not considered part of the sample because her work proceeded as normal, parallel to the research.

The first subject, the researcher, is a teacher who fills the role of the teacher educational technologist. I am able to fill this role because I have experience teaching mathematics to middle and high school students for seven years. As a teacher, I have experience with lesson planning. I know approximately what students are able to accomplish in a given amount of time and have a rough idea of the time students need to learn new concepts. I also have experience working with technology tools as a student and as a teacher so navigating through technology is familiar to me. I have developed my own set of digital pedagogy skills by implementing technology use into my classroom. My current participation in an Educational Technology master’s program provides additional knowledge of technology and the potential uses in the classroom. If my hypothesis is correct, it is the combination of my technology knowledge and my teaching experiences that will help me step into the educational technologist role and support another mathematics teacher.

The learner teacher chosen for this research, Michael [real name concealed to preserve anonymity], has worked as a mathematics teacher for 22 years. During that time he taught middle and high school students. While his mother tongue is not English, he has taught in English for many years.

Michael and I met in February 2019, when he started working at the current school with the middle year students. At the time, I was working with the high school students. While there was some communication and shared resources between us, we did not collaborate often and did not connect much beyond acquaintances.

At the start of the research, Michael had very little experience with using technology. He informed me that his last school did not have much access to technology and most of the teaching was done through hard copy. This lack of available technology meant that there were few opportunities for him to develop technology knowledge and skills, whether for personal use or for use as a teacher.

In contrast, the current school we teach at has a wide range of technology hardware and software available and provides many opportunities to utilize the technology in the classroom. When the research began, Michael informed me that he is eager to learn how to use these tools. The lack of technology experience and the interest and motivation to learn about technology use in the classroom made Michael a good candidate for this study. There were many opportunities to support him to learn how to use technology tools and how to implement them into his classes.

Data Collection

The data collection process took place from October 2019 until April 2020. The formal data collection included a survey, interviews, support sessions and lesson observations. While there were numerous informal exchanges, both verbally and through digital channels, the main events of the research are summarized in table 1.

Table 1:

Date	Event
October 2019	Subject fills out survey and agrees to participate
January 2020	Preliminary Interview
January 28, 2020	Support session 1
February 04, 2020	Lesson 1
February 10, 2020	Lesson 1 follow up (survey)
March 06, 2020	Support session 2
March 10, 2020	Lesson 2
March 10, 2020	Lesson 2 follow up (discussion)

March 16, 2020	Distance Learning begins due to COVID-19
March 16, 2020	Support session 3
March 17, 2020	Lesson 3
March 24, 2020	Lesson 3 follow up (discussion)
	Support session 4
March 31, 2020	Lesson 4
April 5, 2020	Lesson 4 follow up (discussion)
	Support session 5
April 7, 2020	Support session 6
April 21, 2020	Summary interview

The orange color in the table represents the start of the research. The light blue represents semi-structured interviews held at the beginning and end of the research. The yellow bars show the support sessions, green bars represent lessons, and white bars represent follow up interviews/reflections. The pink bar represents the unplanned event which occurred during the timeframe that is relevant to the research.

The initial survey was sent to all math teachers in the school and intended to gain understanding of what kinds of technology tools were being used in the classrooms and how often technology was used. The survey was semi-structured with multiple choice questions, check box questions and one short response question. The questions from the survey are included as *Appendix 1* at the end of this paper. The answers to these questions also helped determine which teachers were interested to participate in the research proposed for this thesis. Considering the survey responses, it was determined that Michael was the best candidate.

After confirming that Michael would participate in the research, I held an interview with him to gain further insight into his use of technology in the classroom. Like the survey, the interview was semi-structured so that the interview could flow based on the subject's answers. The interview questions are included in *Appendix 2*. These questions were chosen to determine which technology Michael was using and how the technology was being used for teaching. The information gained from this interview was used to better support Michael in the subsequent support sessions.

After the interview, the next step was to provide support to Michael and help him to incorporate technology into his lessons. To accomplish that, we held a series of support sessions, approximately one to two hours in length, when he and I explored a technology tool together and

then planned how to incorporate the tool into the classroom. The support sessions were held within a week of the planned lesson time so that the knowledge was fresh in Michael's memory and he could feel prepared to conduct the lesson.

The sessions were conducted in such a way that there was a support session, a lesson using technology and a time for reflection. The reflection informed the next support session and thus the cycle repeated. This setup was chosen so that Michael received support that was meaningful and applicable to his teaching practice. The cycle, visible in table one by the alternating yellow, green, and white rows, is also included as figure 2.

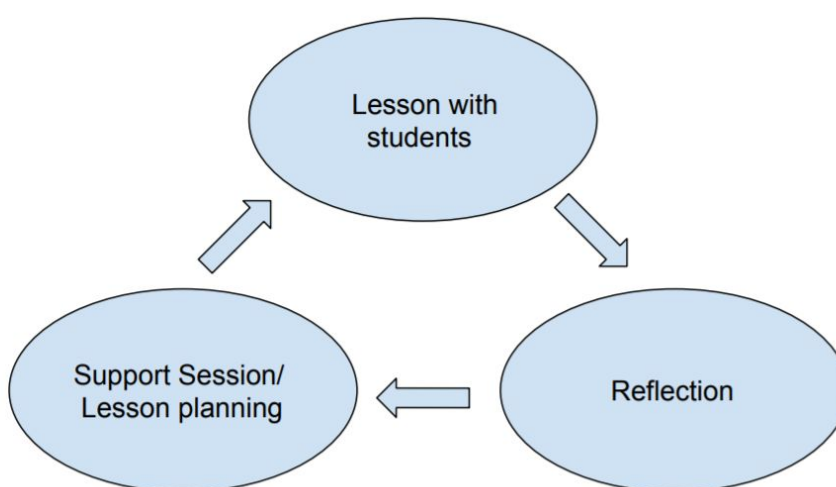


Figure 2. Cycle of support, teaching and reflection utilized in this research.

There were a series of 4 full rotations of support sessions, taught lessons, and reflections. The first two rotations were completed as separate events (e.g. one meeting for support, one lesson, and one time for reflection), however, the disruption caused by the mandated distance learning due to COVID-19 (Estonian Ministry of Education and Research, 2020) led to an adjustment where the reflection periods started to flow directly into the support session. The reflection focused on the needs experienced by the teacher and students during the lesson and this transitioned the session into learning how technology can be used to meet those needs. These later support sessions were slightly longer in length, approximately 1.5 to 2 hours, due to the combined activity of reflection and support session.

Following the series of support sessions, lessons, and reflections, the research concluded with a summary interview, asking Michael about his perception of the experience. The semi-structured interview questions used for this interview are included as *Appendix 3*.

As a basis for comparison, I also interviewed the school's educational technologist, let's call her Annika [real name concealed to preserve anonymity], as part of the research. The purpose was to get her perspective on the assistance she gave Michael, any progress he made, and any other insight she might have into my work as a teacher educational technologist. I had information about this from my own reflections and from Michael but having a triangulation of perspectives could provide valuable insight when trying to answer the research questions. This was also a semi-structured interview and the questions are included as *Appendix 4*.

Results

Results of the support cycles (support session, lesson, reflection)

The initial interview informed me that Michael had limited experience with using technology in the classroom. He mostly uses the school's online communication program to share resources with students. When he wants to share something from a textbook he can scan and send the source to his email, then upload it into the system for students to access. He mentioned using the projector to show information in class and of taking snapshots of graphs if needed.

With the knowledge that Michael did not have much experience with technology use, I presented an easy tool in support session 1. Michael had informed me that one of his classes, grade 7, was learning how to solve linear expressions (e.g. $2x + 1 = 3x - 6$). I suggested showing the students an application called PhotoMath (<https://www.photomath.net/en/>). With this tool, students take a picture of a mathematical question and then receive the solution and the steps for answering the question as an output. A screenshot of the application is included in figure 3.

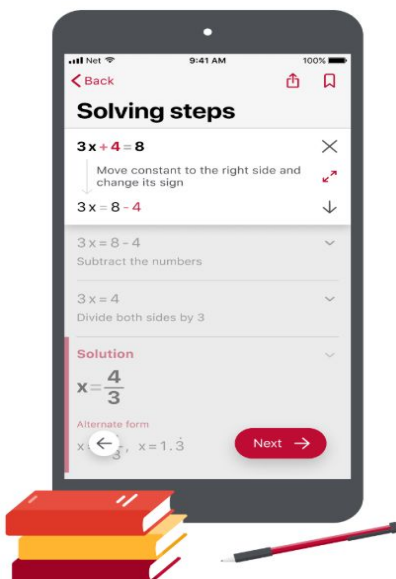


Figure 3. Screenshot of the application PhotoMath (Photomath Plus, n.d.).

I showed Michael how the application works using my phone. We discussed how it could be useful to students and how to introduce it to them. I chose this tool because it is applicable to the mathematical content that Michael's students had just learned. It is easy to download the program to a cell phone or tablet, which students would most likely have with them, and did not require any extra planning to reserve the school's computer lab, iPads or laptops. Also, compared to other mathematics technology tools, this is a tool that students could download and use without much direction from the teacher.

We planned to start the lesson as Michael usually does, by reviewing the homework with students and supporting them. He would then extend student learning to include solving linear equations with distribution (e.g they would solve expressions of this format: $3(x + 1) = 2(x - 5)$). As the students had encountered distribution before, we expected that they should be able to transfer the skill to the current context without much difficulty. We planned time for students to practice questions and then transition the lesson to incorporate technology. We would transition by showing a video of how to use the PhotoMath application for solving any equation and then support them to download and try the application using the examples they had just solved. If there was time left at the end, we planned to discuss the tool and ask the students' opinions of using it in mathematics classes.

The lesson was conducted one week later. Michael and I met just prior to the lesson to ensure that he was ready and see if he had any questions or concerns. There were no concerns that he shared with me at that time.

Michael started the lesson as planned. He introduced the linear equations with distribution and students solved these problems together. When it was time to transition to the PhotoMath tool, Michael paused like he was unsure what to do next. I sensed that he wanted me to take over the class. This was not my intention but I moved to the front of the class to help him set up the projector, the speakers and run the video. As Michael still did not seem confident to lead the lesson once the video ended, I stepped in again. Since many students told us that they knew about this tool and had used it before, I transitioned to a class discussion of the tool and the pros and cons of using it in school while Michael observed.

As Michael had other classes immediately following the observed lesson, we were only able to speak briefly. He said that he had no idea that students already knew about this application but he was glad to learn this. He also informed me that he was surprised how the students seemed more calm and engaged than usual.

The intent was to meet with Michael for a follow-up reflection session; however, challenges interfered during the week that followed. I sent him a written interview in lieu of a face-to-face reflection session to prevent having too much time between the lesson and the reflection. The questions are included as *Appendix 5*. From his responses, I learned that Michael enjoyed the lesson and that he felt the “students pay more attention and they participate a lot in the lesson when technology is used in the Math lesson”. He said that their participation makes him want to incorporate technology into lessons in the future and that he is willing to conduct more lessons using technology, with or without my assistance.

A few weeks later, after a school holiday, Michael and I met individually for support session 2. During this session I showed Michael how to use Desmos (www.desmos.com). This technology tool started out as a graphing calculator but over time the company has expanded to include free classroom activities that teachers can use to introduce mathematical concepts to students and help them understand mathematical relationships visually. Teachers also have the

option to build their own activities to better suit their teaching needs. A screenshot of the Desmos activity center is included in figure 4.

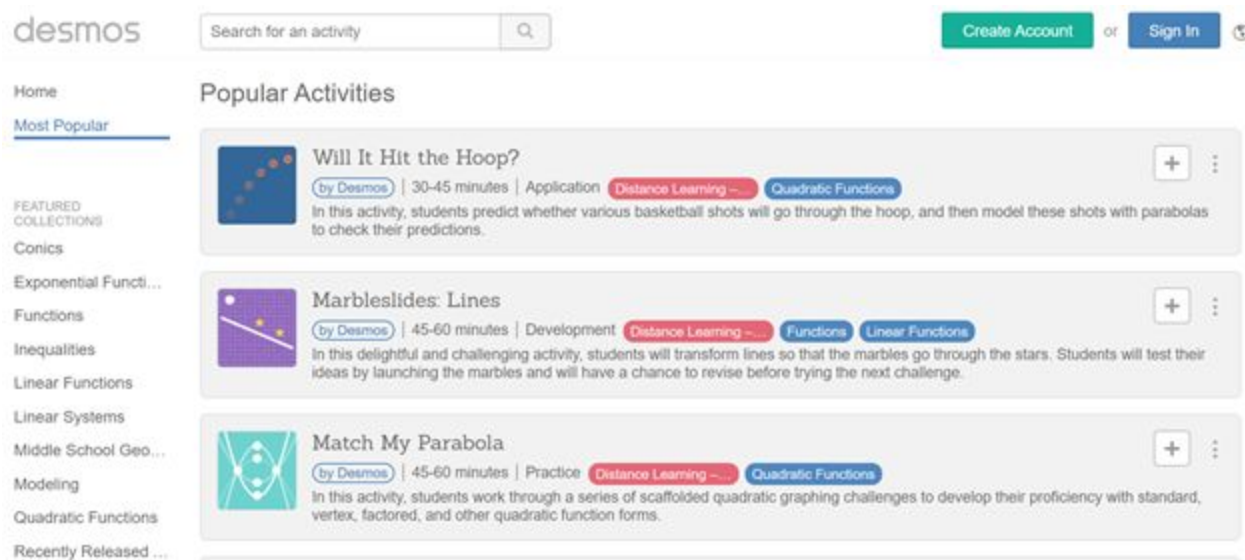


Figure 4. Screenshot of Desmos Teacher Activities (Desmos | Beautiful, Free Math, n.d.).

Using an activity that Michael found which related to his teaching unit, I explained some of the features of the tool and showed him how to create the activity code for students to access, how to share the activity with the students, and what the activity view looked like from the teacher perspective and from the student perspective. We discussed reserving the school laptops for the upcoming lesson and the structure of the lesson plan which he would teach to his grade 6 class.

As the Desmos tool is more complex than the PhotoMath application, I planned to be available to provide to Michael during the lesson. We met early to collect the laptops students would need and set them and the projector up in the classroom.

There was some confusion at the beginning of the lesson and at least five minutes was devoted to helping the students 'log in' to the activity (students do not need to create an account to participate). Michael moved around and helped the students during this time without any guidance from me. Once he gave permission to begin, the students started working while I supported Michael to use the teacher dashboard in the Desmos system. I helped him to 'hide the

student' who had logged in multiple times, so that it would not distract him while observing the active students. I helped Michael answer students' questions and reminded him of the 'anonymize' feature in the system when one of the students was reluctant to share his answer with the class. When Michael noticed several incorrect answers in the teacher dashboard, we checked the students' answers and I pointed out that many of them demonstrated understanding but their answers were not recognized by the system, so it was marking the answers wrong. I told him that this is one of the limitations and that it would require him to check any answers that the system marked incorrect.

Michael spent part of the class time moving among students and part of the time checking the teacher dashboard. Even though he and the students were using the tool for the first time, most of the students were able to finish the entire activity within the class period.

After the students left, Michael said that he was pleased with the way things went and asked if we could do another Desmos activity. He said that this was usually his noisiest class and that while they were working they were silent and he could see their motivation to work. He was also impressed that the students had learned about the coordinate rules for shifting the diagram. He did not intend to teach them this skill, because he felt that if he had taught them on the whiteboard, they would not understand. He was surprised that in the activity the students were able to reach that understanding on their own. We agreed to try the other activity that he found from the workshop the following week.

Michael and I intended to meet to reflect on lesson 2, however, the Ministry of Education issued a mandate that schools would move all learning to online platforms as of March 16, 2020 due to the COVID-19 pandemic (Estonian Ministry of Education and Research, 2020). While this required a change of tactic, it did not hamper the research. Instead of meeting in person, Michael and I switched to online communication and continued support sessions and lessons.

We held an impromptu support session 3 on March 16 to create a lesson for the following day. Michael informed me that his original plan would not suit the students in the distance learning format so he requested help finding a suitable Desmos activity. When we could find nothing, I explained that we could create an activity within the platform. I offered to do that for

him if he would tell me what topics to include. He used the activity that I created as lesson 3 of the research process.

A few days later, Michael and I met via Zoom (www.zoom.us), a video conferencing tool. He informed me that the online lessons were too slow because he was having difficulty communicating the mathematical work to students. He was using a marker and paper to write equations and then hold them up to the camera for students to see. His first concern was a solution to this problem and he asked about how to use the whiteboard feature within Zoom.

Since typing equations or using the computer mouse to draw was too slow, he asked about connecting a second device to the program to use as a touch screen. He had heard that it was possible to connect an iPad but he did not have one available to do that. We discussed possible solutions to this, which included trying to connect an Android device as either a touch screen or as a second camera if he wanted to continue writing on paper. We also discussed contacting the school to see if they would loan one of the school iPads for the duration of the distance learning situation. While I was able to provide Michael with some options, unfortunately, we were unable to come to a definite solution during this session.

Next, Michael informed me that the Desmos lesson went well and asked me to show him how to make his own activities. I shared my screen and showed him how to either select and modify an activity and how to create an activity from the beginning. I showed him how to modify settings and told him that some of the activities cannot be edited. I told him when I am looking for activities, I start by seeing what the activity offers, then I decide if I like it as it is or if I want to modify something. Then I check if I am able to modify it and decide if I want to use the activity or not. He shared his screen so that I could help direct him to create an activity. We only created one slide of an activity during the session but I encouraged him to try more on his own.

The following week, Michael held another Desmos lesson (from the database, not his own creation) with students. He contacted me during the lesson because he could see that students needed guidance and he wanted to communicate with them using the Desmos platform. I told him that, as far as I knew, this was not possible but that I would look into solutions. In the meantime, I suggested he try to email students or keep a Zoom chat open so that he could talk to them while they worked. After talking with Michael, I researched the topic and discovered that Desmos was

beta testing a “written feedback” feature and that we were able to test it. I forwarded the information to Michael and we agreed to meet to discuss it.

During support session 5, I showed Michael how to turn on the ‘written feedback’ feature in Desmos. We simulated a lesson so that he would know how to provide the feedback to students and discussed how to make sure that students knew when they received a message. I also pointed out a limitation that the communication was not two-way. At the time of this support session, teachers could only send feedback to students within Desmos so he should still consider having an alternative way to communicate with students.

We talked again about the challenges of having a system inaccurately indicate wrong answers. The students were frustrated that their answers were marked incorrect when it was correct. I told him that I had experienced this problem with other programs as well and suggested that he use the opportunity to discuss the limitations of technology with students and help them to be mindful of their work.

In the same support session we also discussed another technology platform, GoFormative (<https://goformative.com/>), which is a tool for gathering formative assessment data from students. A screenshot of the teacher’s work space, including formative assessment tasks is in figure 5.

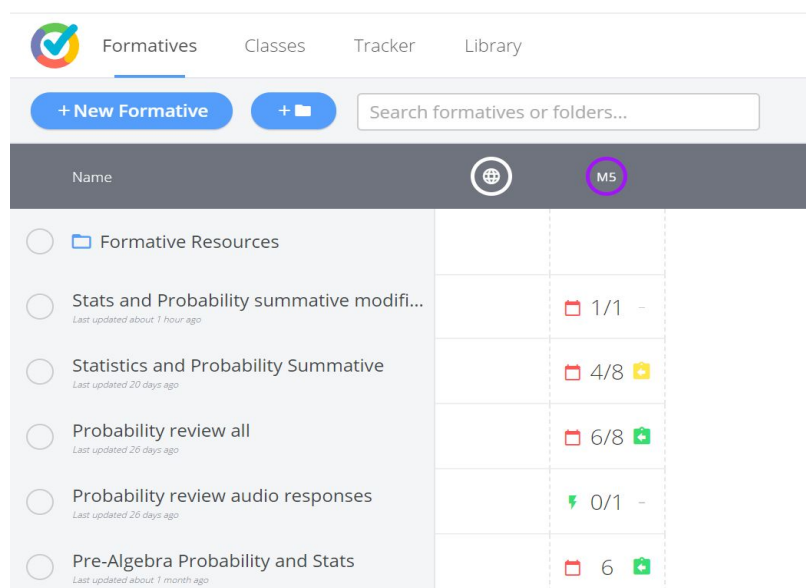


Figure 5. Screenshot of the teacher work space in GoFormative (GoFormative, n.d.).

Michael pointed out some differences between this program and Desmos, and I asked him to show me what he had learned about the program already. He shared his screen and showed me the classes he had set up and how to add students to the classes. He showed some activities he used, told me how to create activities from the library of shared materials and showed how to modify the materials. He also showed the options for assigning the work to students, which includes the option to schedule when an activity opens and closes, how to assign work to particular students and choose whether students can edit the work or see the correct answers after they submit. We discussed the opportunities for differentiation by selecting different settings within activities. He also showed me how to communicate with students and said that this feature was the reason he asked me about communication in Desmos.

I was impressed with how much he was able to show me and I asked if he had learned how to use the program from someone else or if he tried figuring it out on his own. He said that one other teacher showed him how to use the basics of GoFormative and that he has tried using it on his own three times since then.

As we were wrapping up the 2 hour support session, Michael told me that he doesn't plan to use Desmos in the next few lessons because there are no activities available for the unit he will teach. He said that if activities were available he would use it, because students really like it. He told me that the students are motivating him to create more activities in Desmos or GoFormative. He said, "It is good when you see that your students really like a certain method of teaching. It is really good to orientate your teaching towards that method. They will focus their attention and they will learn better."

Two days later, Michael and I met for another support session to further discuss GoFormative. Michael showed me how to upload a document and insert questions. He struggled to upload a word document but when he switched to a pdf there were no issues. I was unable to explain to him why the Word document would not upload. I pointed out that this was a potential weakness of my technology knowledge, saying "when it goes wrong, I don't know how to fix things. I know how to use things, but I don't always know how to fix things."

Once we got the pdf uploaded, Michael showed me how to insert questions. While he was explaining how to select the question type, he realized that he can select the question type he

wants as soon as he inserts the question into the document. Before this he told me he always selected the ‘numerical answer’, thinking that this was what he needed to choose for a mathematical answer.

We concluded that the tool was similar to Desmos, in that teachers could create activities for students, but that GoFormative was perhaps easier to use. “I find it less time consuming,” Michael said. By exploring the tool together, we learned that GoFormative has the options to upload and modify material, the ability to communicate back and forth with students, and options for automatic grading that can reduce teacher workload. From observing Michael in the support session, the program seems relatively intuitive for someone who is new to technology use. At the time this report was written, Desmos had some options for automatic grading and the ability to give feedback to students, but for a new-to-technology teacher like Michael, mastering the Desmos tool takes more time and practice.

Next we discussed Zoom and how to set up a meeting. After an update from Zoom, Michael was unable to create a meeting using the application he had downloaded to his computer. I told him that I use the website to create meetings and shared my screen to show him how to log in, create a meeting, choose the proper settings and then copy the link information to share with others. We attempted to create a meeting using the application but we ended the meeting by accident and had to create a new one. Once we resumed the meeting, I helped Michael adjust the settings, so that the language would be in English and the time zone was set to the proper time, and I helped him schedule a meeting for his next lesson.

Following the sixth support session, I felt that we had reached a point where further support sessions would yield similar results and thus be repetitive. I scheduled a final interview with Michael to gain insight into his perspective of the research experience.

Results of the Interviews

In this section I highlight some of the responses received from Michael and Annika during the interviews. I will also share relevant reflections that I recorded throughout the entire research.

Michael

During the final interview I asked Michael how the experiment affected his teaching. He responded,

Your work really came at a good time because I was not really using the IT very well to teach. I started using Desmos when you started your work. It was really a very good experience and it really helps me a lot when the distance learning starts. The little experience I had with Desmos helped me to quickly understand GoFormative as well. So it was really very useful for me.

He said that he really likes GoFormative. He didn't feel that it was necessarily more intuitive than Desmos, but the ease of uploading a resource into the GoFormative made it faster and easier to achieve his goals. He told me that he plans to continue using both tools even after the distance learning situation ends. He feels that students are very comfortable with the programs and that he can use the activities as both formative or summative assessments. He particularly likes the automatic feedback feature, as it saves him time and the students receive feedback immediately.

When I asked how he has grown as a teacher, Michael responded that he learned a lot during this distance learning period and that he feels the situation helped him to learn more about the technology than he might have. He feels that he is more efficient due to his improved use of technology. He expected that he would need to use technology for many years in order to see the benefits but that he realized quickly that this was not true; "At the beginning I thought for me it was time consuming, because I had to learn some things, but [...] after I learned, I started using technology, [then] I really saw that it was less time consuming." He said that the more experience he had with technology, the more intuitive new tools became. Also, he feels his use of technology as a teacher is beneficial for the students because they feel more comfortable doing work in an online setting than in their notebooks and which helps motivate them to participate and learn.

When I asked Michael how the support that he received from me was different from the support he received from the school's educational technologist he told me that the help received from Annika was more for the general use of technology. For example, Annika showed him how to take screenshots or scan and send documents, which helped with his teaching, but the support for using new technology tools in the classroom with students (e.g. GoFormative and Desmos) came from me or other teachers who have also used these tools in our own classrooms. As a follow up question, I asked Michael whose support was more valuable to him. He responded "I

think yours is more valuable because it was specific in mathematics, that is in my subject that I teach [...] it was yours that really boosts me to learn the other one faster.” He also mentioned seeing other teachers continue to struggle because of their lack of experience with technology and that he appreciates the knowledge and skills he has acquired.

Next, I asked Michael who he went to when he needed support. He responded that, in school, he often went to Annika first, “because she was available”. If he could not find her, he would ask me or another colleague who had more experience with technology. During the distance situation, he often came to me first, because his questions involved the tools he used during lessons.

Through the sessions, Michael had mentioned talking to a colleague in Thailand about technology. I asked him about this colleague and Michael told me that he often shared things he learned from me with his former colleagues. He said “when I experienced that, for me, it was really very good. I could not keep it to myself, something that will ease teachers’ work!” For this reason, he has been trying to help his colleagues.

As a final question, I asked Michael if he felt schools needed to hire a specific person to be an educational technologist, or if supporting one another with technology was something that teachers could do as a part of regular collaborative work. He responded that the work done by the school’s educational technologist is important, but that he doesn’t see the same type of work being necessary in the future. Those who are teaching now who have no experience using technology to teach, they need support, but the current students have knowledge of technology use, so he expects that eventually the new teachers will have the basic knowledge technology tools they need to incorporate technology into classrooms. He pointed out that sometimes the students are able to support him, because they already know what to do and that people could learn how to use the tools on their own by searching for help videos on the internet. So right now he feels that someone who is hired solely as an educational technologist has valuable support to offer but perhaps, in time, the position becomes less necessary.

As we concluded the interview, Michael said that he enjoyed the experience, that he was grateful for the support and that he wants to continue working together after the research finishes.

Annika

In the interview with Annika, I asked what her role was, as the educational technologist at the school. She responded, “the problem is that because it’s kind of more or less a new thing [...] how each school decides to use this person is very different.” At the moment, she is mostly helping those teachers who have never used technology, or have rarely used technology, just to start using something. Often her time is spent meeting with teachers and showing them how to work within a program. She also consults with teachers if something is not working and works with the teacher to determine what platform will help them meet their goals. During the distance learning she was not providing new technology suggestions or information, so as not to overwhelm teachers, but she plans to do that again once the school resumes face-to-face lessons.

She told me another component of her work involves strategic planning. She meets with the director to discuss how to develop technology use in the school. She compares platforms and tries to plan for easy and efficient tools that the teachers and students would benefit from.

When asked about her experience with technology, Annika informed me that the skills needed for the position are variable. Her background is not IT and she thinks that the educational technologist should be “a person who is more or less understanding the logic of programs, who is at least an ‘experienced user’.” She informed me that she is part of an educational technologist support group and she can contact people with a stronger IT background who can provide help or support if necessary.

When asked how she supported Michael, Annika responded that she did not help him much. At the beginning she helped him scan documents or take screenshots. She helped him try to incorporate mathematical graphs into a Word document and organized loaning the school’s iPad to connect to Zoom. She said that, “I think most credit should be yours, because I think that the only thing I told him really is that I have time for him [...] I showed him small things [...] and then I told him that actually because I am not a math professional [...] that it would be more resultative if he speaks to you about these specific things.”

She told me that she felt Michael was “trying to approach this new internet world with his old understanding” and so he was often trying to accomplish things in a way that was harder than it needed to be. She encouraged him to step away from the old methods and try new technology

tools. “I think what you are doing with him [...] is most productive, the only thing I could help him with was Zoom.”

When asked if there was a difference between her as a full time educational technologist and me as a teacher educational technologist, she replied,

I really don't see a big difference [...] I understand that you are having your own classes and so you cannot be there 100% of the time for him so maybe my position would be this, if he hadn't received any possible help from you then I have time to sit with him and figure it out, it will take much longer time because I have no idea how things work, I mean in math, but we will do that and he will receive help. So I think this is maybe the small difference but all the rest I think is very similar. Actually I do believe that it should work like that, subject teachers have their own group where they share different tools and maybe even if you have the same level of children, the same grades, maybe even materials because time sharing is not so complicated, so partly we are all educational technologists, this is what I am trying to say.

Finally I asked Annika if she felt that she was lacking something by not having teacher experience. She said that “definitely experience gives much more possibilities [...] When we started using GoFormative I used it just as a trial version. I saw a lot of videos so I know some peculiarities but as soon as teachers started using it more actively they had very deep questions which I could not experience [...] I realized that I cannot answer several questions.” She clarified that she can manage now because she consults with practicing teachers who use technology well. She asks them what problems they experience and how they attempt to solve them so she has “a team of people” but that she has to “deal with that in a bit longer path than if I would have this [teaching] experience”

Researcher reflections

As the research questions address the growth of the teacher educational technologist and the perceived benefits or challenges associated with the role, I will share some reflections that I recorded throughout the research.

At the start of the research, I introduced tools to Michael and taught him how to use them with students. I helped him choose appropriate tasks, I pointed out strengths and weaknesses of the tools and I shared what I utilize in my own classes. In lesson one and two, I had to help Michael set up the video, computer, speaker, projector and laptops. In the reflection, I wrote “I

did not anticipate the time it would take to deal with all this but it is part of the support an educational technologist should provide.”

In support session 3, I struggled to find a solution to an inquiry from Michael. In the reflections I wrote “I didn’t know how to help [...] It was difficult to describe what I was thinking. Had I had more experience with this I could show him quickly [...it] was a challenge not having general knowledge of lots of different solutions” During the session, I searched for a solution online and shared with Michael an article and a video about connecting an Android device to Zoom instead of an iPad. At the end, I told Michael “I didn’t have experience with the whiteboard so today we both learned something new!”

When Michael was learning about Desmos, I wrote,

I could almost see him thinking and processing what I said. He kept saying ‘I see,...ah ha, yes I see, so...’ and I was trying to watch his eyes move around the screen to understand what he was looking at.” While he was learning about GoFormative I wrote “I asked questions and guided him as much as possible, given that I did not have much experience in the program. Some of the buttons were intuitive to a native like me but were still not always clear for him so even though I did not know the program sometimes I could figure out what needed to be done, whereas he was struggling.

After support session 5, I wrote that

“we got to discussing the difference between use of technology as a communication tool / way to transfer information / assessment tool and using it as a tool to teach and develop understandings and relationships. We compared Desmos and GoFormative and basically got to the fact that both are good, necessary tools for different purposes. It struck me that I could have such a conversation with someone who only a few short months ago had very limited tech knowledge and skills that he was thrilled at being able to scan, email and project information onto a screen. This two way development is invaluable; watching someone learn a tool helps me to think and learn and also the inquiries force me to find answers that I may not have needed/wanted to find otherwise.”

After support session 6, when Michael showed me how to add questions into GoFormative, I wrote,

I realized I am allowing him to construct knowledge by listening to his explanation of how to work the tool and offering some guidance if he gets stuck (just in time assistance). I am teaching him as I would teach my students. I am allowing him to inquire what and how to do things and I am allowing him to try to figure it out for himself and assisting when necessary. This experience in the classroom TEACHING someone could be very valuable.

As a final reflection of the process, I recorded what has changed in my own teaching practice as a result of this research. I wrote,

I have more experience creating activities in Desmos and have started using the ‘written feedback’ feature. I have implemented GoFormative into my classes and have recommended to the coordinators that we invest in the program so that we are able to keep using it after the distance learning mandate is lifted. I have been able to meet the needs of some students better. Some of the features the tool offers support differentiation, and Michael and I discussed how to achieve this during our sessions. While I have not been able to yet, I intend to try Michael’s suggestion about an iPad touch screen to share answers in class and motivate class participation.

Discussion

The results of the research support my hypothesis that the teaching experience of a teacher educational technologist influences the support they provide to other teachers. I will separate the discussion into subsections to address answers for each of the research questions.

1) How has the learner teacher grown in their practice as a result of support from a teacher educational technologist as opposed to the general educational technologist?

Throughout the research experiment Michael made good progress. “This distance learning has really pushed me to use technology a lot. But I am really learning so much” he said. He went from scanning and projecting hardcopy materials to uploading and creating materials in online platforms. Due to the distance learning mandate, he needed to transition from face-to-face teaching to completely online teaching and he stated in the final interview that he was able to be more successful in this endeavor because of his participation in this research. Perhaps what speaks most to his progress is that he has stepped into a mini role of teacher educational technologist, by helping other mathematics teachers to learn about technology. In a message to all teachers, Annika highlighted teacher achievement during the distance learning situation. She too recognized Michael’s achievements, by acknowledging that he is the school’s Zoom whiteboard professional and is one of the active teachers using GoFormative.

From the final interviews we see that Michael grew in his practice in different ways from the support he received from the general educational technologist and from the teacher educational

technologist. From Annika, he was able to learn about using technology for more general solutions, for example taking screenshots, integrating graphics into a Word document, and finding solutions to hardware challenges with Zoom. These skills are more useful for communication, not for teaching. From me, Michael learned how to find and create learning activities using technology tools specifically for teaching mathematics. He discovered that technology can make his teaching job more efficient and that having experience with one tool opens up opportunities to use other tools.

Further evidence of Michael's growth is his ability to discuss the use of technology for teaching. Now that he has some knowledge and understanding of what can be accomplished through the use of technology, he is thinking of ways to use it more effectively. He mentioned continuing to use an iPad as a touchscreen during face-to-face class in an effort to increase student motivation to participate. He envisions being able to pass the iPad so that students can share their answers from their seat. He hopes this motivates students to participate and eases discomfort by not having to work in front of their peers. We also discussed how to utilize the features in GoFormative to differentiate assignments for students who need different types or levels of support. These discussions show that Michael is not simply learning how to use the technology tool but how to use it to meet the needs of students.

The fact that Michael does not need the same type of support at the end of the research is also evidence of his growth. The discussions in the last few sessions turned to how to improve the use of technology or how to use technology in different ways to achieve different goals. Once Michael received support from a teacher educational technologist he was able to start using technology tools specific to his subject and begin developing his digital pedagogy.

2) What are the perceived benefits/downfalls experienced by a teacher educational technologist?

There are positive and negative components to having a teacher fill the role of an educational technologist. I will discuss my perception of the benefits and downfalls, having experienced the role during this research.

The first perceived benefit to being a teacher educational technologist is that one can improve their own teaching practice. During this experience, I was able to share my knowledge

about what works and what doesn't work with students in regards to both mathematical approaches and technology use. I had opportunities to reflect on my philosophy about technology use and why I chose to approach it in a certain way. I had opportunities to collaborate and brainstorm ideas with a colleague how to use technology effectively in our subject area.

While filling the role of a teacher educational technologist, I learned new features of technology tools that I did not know previously. For example, Michael's inquiry about providing feedback in Desmos led to discovering the 'written feedback' feature, which I have since implemented into my own classroom. Also, while demonstrating how to create activities in Desmos, I discovered that we can insert the calculator directly into the activity for students to use (so that they don't need a handheld device or to switch to another screen).

As I supported Michael, we tested out new technology tools and this collaboration was a valuable experience for both of us. For example, the GoFormative tool was new to both of us. As a result of this research we are both actively using the platform with students. We were both invested in the work because we could each gain something meaningful for our teaching practice. There was also an extra layer of motivation for me to learn new things to be able to successfully fill the role of educational technologist by supporting Michael with his inquiries.

Another perceived benefit was that I became more aware of the potential needs of someone who is new to technology. During the collaboration, I realized that Michael was not familiar with some of the technology "language". Some buttons or directions which were intuitive for me as an experienced user, were not clear for him. Knowing what is challenging for new technology users and where knowledge gaps may exist can help me teach students who might also have little experience with technology.

The commonalities between a teacher educational technologist and other classroom teachers is a benefit to teachers and schools, as it can help foster collaboration. Reports show that when teachers collaborate they "reported to be more motivated, to experience decreased workload, a positive impact on teacher morale, greater efficiency, increased communication, [and] improved technological skills..." (Vangrieken et al., 2015, p. 27). Furthermore, Davidson et al. (2001) writes "the [educational technologists] seemed to have a much more positive effect in the school and with the teachers when they shared a similar background" (p. 14). The research supports

these statements. At the start of the research, Michael and I were simply colleagues, we taught the same subject and asked each other questions now and then. The collaboration during this research has brought us closer together and expanded our teaching practices. Having a teacher fill the role of educational technologist can benefit the students and the school by fostering opportunities for collaboration and better workplace relationships.

One of the perceived downfalls of being a teacher educational technologist is that my attention was spread out between many things. I had my own classes to plan and teach, students to support, and the responsibility of supporting a colleague to learn technology and develop his own digital pedagogy, all this in addition to family responsibilities. Having too many responsibilities can lead to feeling overwhelmed by the workload or stressed, if a person perceives that they are unable to meet demands. Both of these feelings can contribute to job burnout and have a negative impact on teaching and learning (Jacobson, 2016).

3) What can a teacher in the role of educational technologist offer that someone hired as a general educational technologist cannot, and vice versa?

Perhaps the most important thing that a teacher educational technologist can offer is the ability to provide digital pedagogy support. The teacher educational technologist in this research has subject content knowledge, as well as experience working with students of the same age as the teacher she is supporting. According to Lorenz et al. (2014), “When ICT methods are presented, the technologist relies on teachers' skills to recognize valuable tools for the content” (p. 293). A teacher educational technologist who has experience with the subject content and working with students already understands the value of the technology tools they present. There can be effective transfer of knowledge because the tools have already been evaluated and accepted as valuable by the teacher educational technologist.

The following examples show instances of digital pedagogy support that I provided during the research. As a teacher who uses technology, I have a rough idea of the time students need to learn how to use a particular technology tool and also use it to learn and practice mathematical concepts with the tool. Lesson one and two were both well timed, which indicates that I can help the teacher to efficiently plan lessons involving technology so that tasks aren't left unfinished and time is not wasted. Of course, even the most seasoned teachers are off sometimes but it is

possible that a teacher educational technologist can provide better support than a general educational technologist in this aspect.

Another example of digital pedagogy support that I provided was in helping Michael to be aware of the challenges or limitations of the technology tool and to provide ways for him to support his students to overcome these challenges. For example, Michael and I discussed the frustrations students experience when the automatic grading system marks their answer wrong but it is a correct answer. I shared how I support students; by making them aware of the limitations, by helping them to learn the proper way to input information and by encouraging them to be self-aware and check their work carefully before submitting.

This underpins why a teacher educational technologist provides better support, because they know the ins and outs of the system and its limitations, as opposed to a general educational technologist, who should have a broad range of skills and experience with learning technologies that can be applied in different contexts (Corbeil & Corbeil, 2013; Fox & Sumner, 2014). The experience of personally creating activities in the system and then figuring out what works and what doesn't work with the students is knowledge that a general educational technologist might not have. Annika confirmed this in her interview, stating that she does not have this experience and that it takes her longer to support teachers when they have these types of "deep" questions.

Further examples of digital pedagogy support is when I shared the way I use technology for teaching. I shared the process for evaluating, selecting and implementing appropriate technology tools or activities into my classroom. I informed Michael that I use the video chat "in the background" during the distance learning while students are working so that they can ask questions if they need to. We discussed solutions for using technology for differentiation and that by creating two class codes or two activities, we can set extra time or provide modifications to the material in order to meet the learning needs of different students. By sharing what solutions I use, Michael can start to consider options that might also work for him and his students.

Another beneficial contribution of a teacher educational technologist might be in how they provide information. During support session 5, I realized that I was allowing Michael to construct his own knowledge by listening to his explanation of how to work within the tool, even though I already knew how to do what he was showing me. I let him explain his understanding and offered

guidance if he got stuck. While there are many approaches to teaching, I had unconsciously slipped into my normal teaching habits, which is allowing students to explain their understanding and construct their own knowledge, with guidance as needed. This “just-in-time direct instruction promotes knowledge construction in a way that makes knowledge available for future use in relevant contexts” (Hmelo-Silver et al., 2007, p. 100). Had Michael been told how to do something, instead of figuring it out on his own, then he could forget it or not truly understand the value in being able to do what he discovered. There is a feeling of accomplishment and ownership that accompanies figuring something out on your own. Additionally, the understanding that he gains from constructing his own knowledge can also transfer into other programs. For example, when Michael learned about providing feedback in GoFormative, he naturally inquired how to do that within Desmos as well. This is not to say that all people cannot utilize this approach for teaching but being patient enough to let the student formulate their understanding and refraining from jumping in to do it for them is difficult. The experience of teaching on a daily basis might make a teacher better at this than other people.

Another benefit of a teacher educational technologist is that a teacher is comfortable in front of a classroom and can lead by example. In the first lesson, Michael was uncomfortable to teach the part of the lesson with technology. This led me to take over the class. Lorenz, Kikkas and Laanpere (2014) stated that it is a typical task for educational technologists, when they help teachers to use technology in their classrooms, but the “only threat seen is to 'hijack' the lesson from the actual teacher” (p. 292). This is what seemingly happened in the first lesson. I would propose that, while it might look like the educational technologist has hijacked the lesson, it could lead to a positive learning experience. By stepping in to help, Michael was able to observe how I would lead the lesson. I provided a model for him to mimic, which happens “unconsciously in the natural learning process when there is a performance model to observe” (Criss, 2008, p. 46). By stepping in, Michael could learn a different way to teach his students. During a discussion with Annika, she mentioned that she also thinks teachers want someone to act as a model for them. She feels that teachers can get inspired to learn how to use technology when they see their students engaged and motivated.

As opposed to a teacher educational technologist, the literature and the research indicate that a general educational technologist could offer a wider selection of tools or solutions for teachers' needs. A general educational technologist is likely more immersed in the world of technology and will have more exposure to technology options and time to explore and learn about those options. For example, at the beginning of support session 3, Michael asked for help with using the Zoom whiteboard feature. Having limited experience teaching with this particular technology, I was only able to brainstorm with him and search for support videos on the internet. It took a lot of time to do this and in the end we did not find a concrete solution to his problem.

Another potential strength of a general educational technologist is that they are often asked to take the role of a technician (Bardone et al., 2020; Davidson, 2003), provide tech support (Jenkins & Rossett, 2000), and deal with hardware usage (Iqdami & Branch, 2016; Mayes et al., 2015; Ritzhaupt et al., 2010). It is expected that they can troubleshoot (Ritzhaupt et al., 2018; Ritzhaupt & Martin, 2014) or provide fixes. If this is true, then general educational technologists would have more experience solving problems involving technology. For example, when Michael was looking for support with the iPad set up, or alternatively exploring the option to set up an Android phone as either camera or touch screen, I did not have a ready solution for him. However, from the interviews I understand that Annika was able to help.

Another benefit to a general educational technologist could be their availability to provide support. Annika stated this in her interview, that she felt she had more time to offer Michael than I did. In his final interview, Michael also told me that he often went to Annika first, because she was available. Davidson (2003) writes, "the temporal rhythm of the [educational technologist's] day is unique to the position" (p. 742). Each day is different depending on the needs of the people the educational technologist will support. This shows that the research and the literature supports that a general educational technologist, while they don't have completely free time, would have a more flexible schedule than a teacher educational technologist who has lessons and other teaching obligations.

Limitations

There are, of course, limitations with this research that should be mentioned. Firstly, the fact that the researcher was an active participant as the teacher educational technologist can be considered a conflict of interest. While the benefits of experiencing the position first-hand provides an interesting perspective, that perspective is subjective and could lead to misinterpretations or missing details, as the researcher is “too close” to the topic being explored. It can lead to false modesty or selective reporting (Nandhakumar & Jones, 1997). In order to address this, I attempted to record audio or video whenever possible and wrote down reflections of the events as soon as possible. I attempted to be objective and include as many details as possible in the results section, regardless of their positive or negative nature. All interview questions are in the appendix, so that one can get a more detailed picture of the study and the data collection process.

Another limitation is that the research is a case study with a very small sample and that it is difficult to generalize results (Yin, 2018). I would argue that this is an exploratory case study which seeks to understand if there is something of interest to be further investigated. These results are not intended to generalize, only to inform, and this goal has been met. I will, however, discuss particular limitations to this small sample size that could have impacted the findings.

As this was a single case study and I, as the teacher educational technologist, supported one person, it is plausible that I was more often available to support him than would normally be realistic. Any future studies should consider looking into the differences when a teacher educational technologist has a team of teachers that they will support in addition to their teaching responsibilities.

Another limitation could come from the comparison of the support provided by the teacher educational technologist and the general educational technologist. It is assumed that the type and amount of support provided by the general educational technologist is typical to what she would provide to any teacher at the school. However, her awareness of my support for Michael could have influenced the amount of support that she provided to him.

Additionally, the results from this research could be unique to the participants involved. “Technology aside, personal likes and dislikes also dictated the success or failure of the relationships between educators and [educational technologists]” (Davidson, 2003, p. 735). The fact that Michael and I got along and worked well together will influence the outcome of the

research. It could also be partly due to the characteristics of the people involved (e.g. Michael's motivation to learn or Michael's and my work ethic/commitment to the research). If future studies involve a larger sample, then there would be more data to analyse how personal relationships and characteristics might influence the results.

The growth experienced by both Michael and myself, as the teacher educational technologist could also be due to the unique situation. By being fully immersed in technology during the mandated distance learning period, one can argue that Michael learned things faster, almost similar to learning a foreign language where you "learn aspects of a language that cannot be replicated in a classroom" (Rivas, n.d.). His immersion led to different needs from technology use, and more challenges, which in turn forced me as a teacher educational technologist to support him more.

Similarly, each teacher educational technologist is "unique in the cluster of technical skills and educational experience that he or she [brings] to the position" (Davidson, 2003, p. 747). My skills are more specialised to mathematical technology tools but another teacher educational technologist would have a different set of skills, which could be more or less useful to the people they support. Additionally, the support system in place for a teacher educational technologist or general educational technologist should be considered. Someone with less skills or experience could be similarly successful to a more experienced person, if they have a strong support system.

A final limitation to this particular research is whether the experience can, in fact, be repeated. The unexpected COVID-19 pandemic certainly impacted the data collection and results of the study. This led to interesting insights, however, the need to move teaching and learning quickly online cannot realistically be replicated at any given time. Whether to attempt to recreate this situation of complete online teaching, and how to do so, would need to be considered.

Conclusion

This case study investigated the experience of a teacher educational technologist who supported a colleague teacher in order to determine how teaching experience plays a role in the support provided and to answer the following research questions;

1. How has the learner teacher grown in their practice as a result of support from a teacher educational technologist as opposed to the general educational technologist?
2. What are the potential benefits/downfalls experienced by a teacher educational technologist?
3. What can a teacher in the role of educational technologist offer that someone hired as a general educational technologist cannot, and vice versa?

The qualitative study, conducted over approximately 7 months time, involved the collection of data from interviews, support sessions, lessons, reflections and discussions. During that time there was perceived evidence of growth from both the learner teacher and the teacher educational technologist and presented interesting insights.

The research showed that there were similarities and differences between the support provided by the teacher educational technologist and the general educational technologist. Responsibilities listed in some of the literature which were also experienced by the teacher educational technologist included creating materials, introducing technology tools, supporting implementation of both hardware and software technology into the classroom, attempting to solve problems, and researching new tools/solutions.

Interviews from the research showed that Annika and I both attempted to support teachers to effectively use technology for teaching; however, the strengths of each person differed. Perceived strengths of the teacher educational technologist include the ability to model digital pedagogy, which supports the development of digital pedagogy skills, and possession of specialized knowledge of the types of technology tools which are useful in the classroom. Alternatively, perceived strengths of the general educational technologist include a broader range of available technology tools, the ability to find hardware solutions or troubleshoot, and a more flexible schedule for providing support.

The insights gained from the study indicate that there is value in conducting more research into the concept of employing teacher educational technologies. I will conclude by proposing two ideas that stood out for me while conducting this research.

One thing that intrigued me was the idea that the educational technologists often ‘take over the classroom’ presented by Lorenz et al. (2014). I experienced this during the research and

Annika mentioned it as well. Our experience indicates that teachers might be looking for a model to follow. This leads me to wonder whether or not having a teacher educational technologist provide real-time, in-classroom training or assistance would help improve teachers' digital pedagogy skills, especially if the teacher has little prior experience using technology either as a teacher or a student. While teachers often undergo professional development, this rarely happens in their own classroom with their students. Future research could provide valuable insights on utilizing this approach for professional development to improve teachers' digital pedagogy.

A second interesting follow-up study would be to consider investigating the impact of a team of educational technologists in schools. The literature and research indicate that both a teacher educational technologist and general educational technologist has strengths to offer and that there is overlap in the goals and approaches each utilizes to support schools and teachers. Mitchell (1975) mentions a team of educational technologists, each possessing different skills; however, no further literature into such a setup in a school setting was found. I would propose that a general educational technologist as a team leader, who is responsible for finding and disseminating ideas to a team of subject-specific teacher educational technologists, would be an effective way to utilize the strengths each individual has to offer. This setup places a teacher educational technologist as an extra link between a general educational technologist and the classroom teachers. This would allow the general educational technologist more time to focus on the bigger picture of the school, e.g. meet with administrators, consider policies and locate a broad range of tools and solutions to utilize. The teacher educational technologist would acquire specific knowledge of the tools they receive from the lead educational technologist and then teach their colleagues how to use the tools effectively. This team approach would allow for more clearly defined roles for educational technologists in schools. Also, by placing each educational technologist in a role that highlights their strength, this could lead to a more effective transfer of information and better teaching and learning outcomes. While this set up would certainly have associated pros and cons, it is something for a future research to investigate.

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Author's declaration

I hereby declare that I have written this thesis independently and that all contributions of other authors and supporters have been referenced. The thesis has been written in accordance with the requirements for graduation theses of the Institute of Education of the University of Tartu and is in compliance with good academic practices.

Ashley Marie Wallace

05 / 06 / 2020

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Appendices

Appendix 1: Initial survey questions

- 1) What level of mathematics do you teach?
 - a) Primary school
 - b) Middle school
 - c) Secondary school
 - d) Other
- 2) Do you use technology in your classroom?
 - a) Yes, all the time
 - b) Yes, when I can
 - c) Yes, but not much
 - d) No, never
- 3) What type of technology do you use in your classroom? Please check all that apply
 - a) Laptop/Computer
 - b) Projector/Smartboard/Smart Projector
 - c) Calculators (graphical or otherwise)
 - d) Computer software programs (Microsoft Word, Powerpoint, Excel, Prezi, etc.)
 - e) Applications downloaded to a smartphone, tablet or other handheld device (IXL, Desmos, Geogebra, etc.)
 - f) Educational platform (ekool, Stuudium, Managebac, Moodle, Edmodo, etc.)
 - g) Online textbooks
 - h) None of the above
 - i) Other

- 4) What type of technology do your students use in your classroom? Please check all that apply.
- a) Laptop/Computer
 - b) Projector/Smartboard/Smart Projector
 - c) Calculators (graphical or otherwise)
 - d) Computer software programs (Microsoft Word, Powerpoint, Excel, Prezi, etc.)
 - e) Applications downloaded to a smartphone, tablet or other handheld device (IXL, Desmos, Geogebra, etc.)
 - f) Educational platform (ekool, Studium, Managebac, Moodle, Edmodo, etc.)
 - g) Online textbooks
 - h) None of the above
 - i) Other
- 5) What is/are your main purpose for using technology in your classroom?
- a) I use it for organizational purposes
 - b) I use it to give students information and show examples
 - c) I use it for differentiation
 - d) I use it for student engagement
 - e) I use it because I am told I should use it
 - f) I don't use technology in my classroom
- 6) Do any of the following apply to you? Please check all that apply.
- a) Technology is not available for me/us to use
 - b) Technology does not always work properly
 - c) There is too much time required to learn how to use the technology
 - d) There is too much time required to set up the lessons that involve technology
 - e) I don't have enough knowledge about what technology is available
 - f) Technology tools/programs/subscriptions are too expensive

- g) Administration does not support the use of technology
 - h) I cannot find any technology that is appropriate for the level of the students that I teach
 - i) I have already created good teaching materials that don't require the use of technology
 - j) There is too much paperwork involved in changing my teaching to incorporate technology
 - k) There are no good resources in the language of instruction
 - l) None of the above apply to me
- 7) What would it require, if anything, for you to use more technology in your classroom?
- 8) I am looking for teachers to create learning experiences around technology tools. If you are interested and would like to know more about this, please enter your email below.

Appendix 2: Semi-Structured Initial Interview Questions

- 1) What does the word “technology” mean to you?
- 2) What does “technology use in education” mean to you?
- 3) How much experience do you have with technology?
- 4) Do you use technology when you teach?
- 5) What kinds of technology do you use with your students?
 - a) Follow up questions
 - i) Could you elaborate on a particular tool or program?
 - ii) Why do you use these tools or programs?
 - iii) Are there other tools or programs that you purposely don’t use? Why not?
 - iv) Which technology or programs do the students like?
 - v) What do they like the least?
 - vi) Which technology was easy to use?
 - vii) Which technology was hard to use?
- 6) How often do you use the technology you mentioned with your students?
- 7) Have you ever considered using more technology with your students? Why or why not?
- 8) Is there anything you like about using technology to teach?
- 9) Is there anything you do not like about using technology to teach?
- 10) Do you ever feel pressure to use technology?
- 11) What is the biggest challenge of using technology in mathematics classes?

Appendix 3: Questions used in the summary Interview with learner teacher

1. How has the experiment affected your teaching practice?
 - a. How have your technology skills been affected by the research experience?
 - b. Has anything about your teaching practice changed as a result of this experience?
 - c. Do you feel that you have grown as a teacher? How so?
2. How was the support you received from me different from the support you received from the school's educational technologist?
 - a. Was the support received from me more valuable than the support received from the other?
 - b. If you could only have my assistance or the educational technologists assistance, who would you choose? Why?
3. When you needed technology assistance, who did you attempt to contact first? Why?
4. Throughout the experience, you mentioned discussing technology and teaching ideas with other teachers. Did you purposely contact them for assistance/guidance or did a conversation naturally flow to the topic of technology and learning?
 - a. It sounds like you received help, support, guidance, from several people, do you think that we need to label one of them as an educational technologist or should it just be common practice that teachers support one another with both content knowledge and technology knowledge?
 - b. Does someone who is hired solely as an educational technologist have some more to offer than other teachers?
 - c. Do teachers with technology knowledge/experience have something more to offer than someone hired as an educational technologist?
5. Did you enjoy this experience?

Appendix 4: Questions used in the interview with the general educational technologist

- 1) What are the roles, expectations of you as the school's educational technologist?
- 2) What is your experience with technology? For example, do you have programming experience?
- 3) What kind of experience with technology does someone need to have to be an educational technologist?
- 4) What have you done to support Michael?
- 5) What do you see that is different between the support that you can give to Michael versus the support that I can give to him?
- 6) Do you feel like you are missing something by not having teaching experience? Do you think that you would benefit from it? Would it make the job easier or do you get along fine without it?

Appendix 5: Short response written interview questions after lesson observation 1

1. What about the lesson did you feel was successful?
2. What about the lesson did you feel could be improved?
3. Did you enjoy the lesson? Why or why not?
4. Do you think the students enjoyed the lesson? Why or why not?
5. Were the students more or less engaged than usual? What makes you think they were more/less engaged?
6. Do you think that particular lesson was a waste of time or was there value in it?
7. Would you be willing to do another lesson with technology with my assistance?
8. Would you be willing to do another lesson with technology without my assistance? Why or why not?

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